

WHAT IS CLAIMED IS:

- 1 1. A method of accessing an internal chamber of the heart through a vessel
2 having a lumen in fluid communication with the chamber, the heart and the vessel
3 being within a patient's chest defined by a plurality of ribs connected to a sternum, the
4 method comprising:
5 positioning an instrument into an inner lumen of the vessel through a
6 penetration in a wall thereof, a proximal end of the instrument extending out of the
7 patient's chest through a percutaneous access port between two adjacent ribs; and
8 manipulating the proximal end of the instrument to advance a distal end of the
9 instrument through the vessel and into the internal chamber of the heart;
10 wherein all manipulations of the instrument are performed outside of the
11 patient's chest.
- 1 2. The method of claim 1 wherein the vessel comprises an aorta and the internal
2 chamber comprises a left ventricle, the step of manipulating comprising passing the
3 distal end of the instrument through an aortic valve disposed in an aortic position
4 between the aorta and the left ventricle.
- 1 3. The method of claim 2 further comprising attaching a valve prosthesis at the
2 aortic position.
- 1 4. The method of claim 3 wherein the instrument comprises a suturing
2 instrument, further comprising applying sutures to an annulus of the aortic valve using
3 the suturing instrument.
- 1 5. The method of claim 3 wherein the step of attaching a valve prosthesis
2 comprises positioning the valve prosthesis through a percutaneous access port
3 between two adjacent ribs.
- 1 6. The method of claim 3 wherein the valve prosthesis is positioned at the aortic
2 position using a delivery handle removably coupled to the valve prosthesis, the

3 delivery handle being manipulated at a proximal end thereof which extends out of the
4 patient's chest through a percutaneous access port between two adjacent ribs.

1 7. The method of claim 3 further comprising positioning the valve prosthesis
2 through a percutaneous access port in a first orientation and re-orienting the valve
3 prosthesis within the patient's chest into a second orientation before attachment at the
4 aortic position.

1 8. The method of claim 7 wherein the step of re-orienting comprises
2 manipulating from outside of the patient's chest an actuator on a delivery handle
3 releasably coupled to the valve prosthesis.

1 9. The method of claim 7 wherein the second orientation is approximately
2 perpendicular to the first orientation.

1 10. The method of claim 1 wherein all steps are performed without cutting or
2 removing the ribs or sternum.

1 11. The method of claim 1 further comprising visualizing the vessel through a
2 visualization device positioned in a percutaneous access port between two adjacent
3 ribs.

1 12. The method of claim 1 further comprising forming an incision in the vessel
2 using a cutting tool manipulated from outside of the patient's chest.

1 13. The method of claim 12 further comprising retracting the incision open before
2 positioning the instrument in the vessel lumen.

1 14. The method of claim 2 wherein the percutaneous access port is positioned in
2 an intercostal space selected from the first, second, third, or fourth intercostal space on
3 an anterior side of the patient's chest.

- 1 15. The method of claim 1 wherein the percutaneous access port comprises a
2 cannula having a proximal end outside of the patient's chest, a distal end within th
3 patient's chest exterior to the vessel, and a passage therebetween through which the
4 instrument is positioned.
- 1 16. In a valve replacement procedure, a method of positioning a replacement valve
2 in a patient's heart within a patient's chest, the chest being defined by a plurality of
3 ribs, the method comprising:
4 positioning an access device in the chest between two adjacent ribs, the access
5 device defining an opening into the chest between the ribs and having and an
6 illuminating device mounted adjacent to the opening;
7 illuminating the interior of the chest with the illuminating the device; and
8 introducing the replacement valve into the patient's chest through the opening.
- 1 17. In a valve replacement procedure, a method of positioning a replacement valve
2 in a patient's heart within a patient's chest, the chest being defined by a plurality of
3 ribs, the method comprising:
4 positioning the distal end of an illuminating device within the chest through a
5 percutaneous access port between two adjacent ribs;
6 illuminating the interior of the chest with the illuminating the device; and
7 introducing the replacement valve into the patient's chest through a
8 percutaneous access port between two adjacent ribs while illuminating the interior of
9 the chest with the illuminating device.
- 1 18. An access device for providing a percutaneous passage into a chest cavity
2 through which a replacement cardiac valve may be positioned, the access device
3 comprising:
4 a device body having proximal and distal ends, the distal end being
5 positionable between two adjacent ribs into the chest, the device body being
6 configured to displace tissue between the ribs so as to define an opening into the chest
7 through which the replacement valve may be positioned without interference; and
8 an illumination device mounted to the device body so as to illuminate the
9 interior of the chest.

1 19. An access cannula for providing a percutaneous passage into a chest cavity
2 through which a replacement cardiac valve may be positioned, the access cannula
3 comprising:
4 a cannula body having proximal and distal ends, the distal end being
5 positionable between two adjacent ribs into the chest, and having a lumen between the
6 proximal and distal ends through which the replacement valve may be positioned into
7 the chest; and
8 a light-conducting element mounted to the cannula body and extending from
9 outside the chest to the distal end of the cannula body for illuminating the interior of
10 the chest.

1 20. In a valve replacement procedure, a method of positioning a replacement valve
2 in an aortic position of a patient's heart within a patient's chest, the aortic position
3 being disposed between a left ventricle of the heart and an aorta leading away from
4 the heart, the chest being defined by a plurality of ribs connected to a sternum, the
5 method comprising:
6 introducing the replacement valve into the patient's chest through a
7 percutaneous access port between two adjacent ribs; and
8 positioning the replacement valve through a penetration in the aorta and into
9 the aortic position by manipulating a valve-positioning instrument which engages the
10 replacement valve, wherein all manipulation of the valve-engaging instrument is
11 performed outside of the chest.